Saskatchewan
Research Council

ANNUAL REPORT 1983-84

. . . applying science and technology for Saskatchewan's development

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FROM THE CHAIRMAN

Under the very able leadership of its president, Mr. Jim Hutch, the Saskatchewan Research Council has experienced a successful year through progress in the development of new and existing research projects, and through innovative and rewarding achievements by its people.

The position of president was created during the year. It replaced the former position of executive director. Dr. Tom Pepper was the executive director of SRC for many years. On behalf of the board of directors, I wish to express my sincere appreciation to Tom for his years of service and dedication to his role in the management of the affairs of the SRC.

There is no doubt that the coming years will be filled with increased challenges and opportunities for the SRC.

Canada, and Saskatchewan, have suffered from the effects of a very serious recession. Research for new and improved technologies in all sectors of the economy may be the most important factor contributing to the recovery from the recession. Technological change will play an important role in improving Canadian productivity growth performance.

According to a recent Science Council report, Canada's economic future hinges on stimulating innovation and new industries aimed at international trade.

Through recent changes in transportation policies, Saskatchewan can now assume a more active role in international trade. Its product and processes can be marketed competitively on world markets.

Federal and provincial governments are presently offering financial assistance to the private sector for its participation in research and development programs.

Many hi-tech companies have located in Saskatchewan, particularly in Saskatoon. These companies are involved in sophisticated research programs, but they require research support services. The heavy oil refining industry in Saskatchewan is in its infancy. But, the future research needs of this industry will be demanding, and challenging.

The requirements for research services are clearly identified.

Working in conjunction with the universities, the existing hi-tech companies, and the Saskatchewan business community, the SRC may take the leadership role in providing the necessary research services. The opportunity is identified.

The opportunity and the challenge are very real. The SRC will provide the leadership role in meeting the opportunity and the challenge.

By doing so, it will provide the environment for the people of SRC to enhance their personal development programs through participation in stimulating and rewarding projects.

The coming years will provide an interesting and exciting period of time for the Saskatchewan Research Council. I am confident that the SRC will respond by accepting its role as a leader in the scientific community.

I would like to acknowledge the excellent support and assistance during the year of the staff, management, the Minister of Science and Technology for Saskatchewan, Honourable Gordon Currie, and all of the members of the Board of Directors.

Gordon Birney, C.A.
Chairman of the Board of Directors

PRESIDENT'S MESSAGE

"... applying science and technology for Saskatchewan's development". This is the SRC mandate. As the President of SRC, I have accepted the challenge to relate SRC's activities to the needs of provincial economic development and to work closely with the private sector in this development.

The research and development road has not been without its rough spots over the last few years, however, SRC staff through their dedication and timely action have performed well. A determined effort of SRC personnel led to a final 1983-84 budget of $10,308,895 consisting of a $3,876,060 grant from the province to carry out research and development in the interest of the province and $6,432,835 in fee-for-service and contract work with the private sector and various levels of government. A surplus of $177,820 was generated for the year.

"Working together" is a good description of SRC's efforts in the past year. We are working with the private sector, the Universities, Technical Institutes, and all levels of government to create opportunities for the present and for the future. We have demonstrated to the private sector that we are an effective R & D resource with expertise, capabilities and facilities. SRC provides services directly to clients and to consultants as they serve their clients, working as an effective member of the team. This enables many firms to carry out work that they would not otherwise take on.

SRC's R & D activities have led to many direct and indirect benefits to Saskatchewan.

— IRAP (National Research Council's Industrial Research Assistance Program delivered by SRC).
— Agricultural Energy Conservation Program
— Job Creation Program (Students in Industry)
— Remote Sensing
— CAD/CAM
— Pilot Plant Facilities
— Product Testing Facilities
— Gold Exploration Techniques
— Aquaculture Technology
— Canadian Centre for Advanced Instrumentation (development of an acid rain sampler and an air quality sampler)
— Residential Energy Conservation Program

SRC has 17 programs dealing with the needs of the province. We are shifting commitments within various programs to emphasize current priorities such as heavy oil, gold and technology transfer.

An increased emphasis on technology transfer has been implemented whereby technology is developed and delivered directly to the user. Generally, we are dealing with a client who will immediately utilize the technology developed. In areas where the client is of a more diffuse group such as in farming or for the general public. This requires concerted effort on our part to implement the technology through workshops, seminars and other means. This applies to areas such as aquaculture, straw ammoniation and energy conservation.

Our 1977 initiatives in CAD/CAM led to this year's 2.47 million dollar contract from the Federal Government to implement CAD/CAM in 30 Saskatchewan manufacturers. As well, we are developing a CAD/CAM network within the province.

Product design and testing and job creation programs have been active.

For some time, we have had expertise being developed regarding remote sensing. This has culminated in an agreement with the Federal Government to have on location a digital enhancement system operator to enable the SRC to work with government and the private sector in the utilization of remote sensing techniques for the development of Saskatchewan.

— agricultural energy conservation programs have been carried out to help alleviate the cost price squeeze.

"Productivity is the key" to the survival of Saskatchewan's industries in today's highly competitive world markets. Through the various services that SRC has to offer such as CAD/CAM Robotics, JIT (Just in Time) techniques and industrial engineering assistance, we are able to assist our industries to maintain positions of leadership and competitiveness.

Many new initiatives occurred in the period 1983-84 such as:

— the institution of "SRC News" which keeps our clients and others informed about SRC activities.
— a Pursuit of Excellence Program has been introduced into SRC to assist in improving communications and productivity.
— SRC's cooperation with Kelsey Institute and the Department of Advanced Education in developing the Advanced Technology Training Centre.
— delivery of the Inventors' Services Program for the Department of Science and Technology.
— the development of working relationships with various consulting engineering firms and management consultants in Saskatchewan.
— development of working relationships with the universities.
— the Energy Conservation House (a house of the 1950's being computerized and retrofitted).

SRC is working with various government departments, the universities and the private sector to provide a true team approach to research and development in Saskatchewan. Our contribution includes an ability to deliver our expertise, capabilities and facilities in "client time". Thus, we are able to respond quickly to the needs of the client.

We will help introduce innovative processes. For instance, with respect to CAD/CAM Robotics, we are working with Canada Employment and Immigration and the Saskatchewan Department of Labour to introduce these new technologies into the workplace.

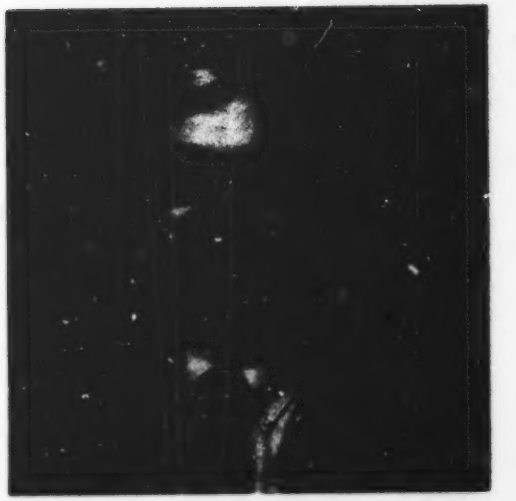
In an organization such as SRC, talent is the key to success. Our scientists, engineers, technologists and all support staff are critical to carrying out our mandate. To bring ourselves more towards a people-oriented organization, we have created a position of Manager, Human Resources, which assures that we provide a suitable work environment that will inspire creativity and innovation.

SRC orients its programs to the needs of the day and perceives problems of the future. In this respect, we are considering future directions in conjunction with committees of our Board of Directors. Saskatchewan's industry must be at the forefront to remain competitive in the world scene.

Saskatchewan trades in the world and we must be leaders in pricing and quality to maintain our markets throughout the world. Over the past years, SRC has helped deliver the technological needs of our industries by working very closely not only with industry, and the Universities and Technical Institutes, but also with all levels of government and government departments. By this, "working together" atmosphere that has been created within the province, we are seeing efficiency within the research and development community for which we can be proud.

Saskatchewan is known for developing unique solutions for those unique problems that face us. We look forward to the future with confidence that we shall continue to grow as an important factor in the development of Saskatchewan.

Jim Hutch
November 23, 1984



RESOURCES

... providing applied research, development and demonstration projects for the benefit of Saskatchewan's growing industrial, agriculture and resource base.

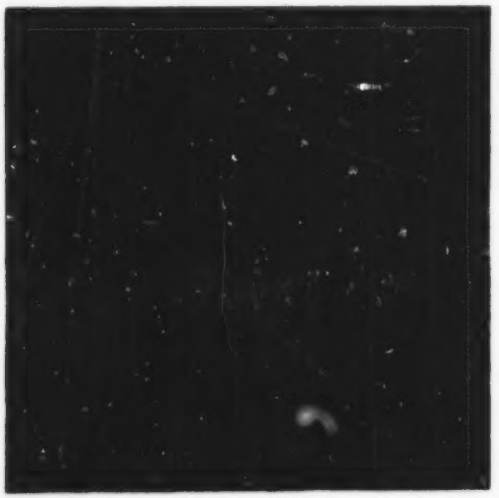
Investigation of groundwater flow conditions under the Cominco potash mine tailings pile was facilitated by the installation of piezometers, using a drilling rig, to monitor groundwater movement.

The focal points for studies and contracts in this sector were solids transport, energy conservation, biomass, and sedimentary and mineral resources.

Resource Processing

One of the most economical and environmentally acceptable ways of transporting large quantities of solid materials over long distances is slurry pipelining, where the solid is suspended in a suitable liquid carrier. The theory of moving solids through a pipeline has not been developed to a point where accurate predictions of the performance of specific materials can be made. SRC is obtaining this performance data from tests in scaled-down pipeline loops.

The SRC Slurry Pipeline Laboratory is recognized as having world-class expertise in slurry pipeline technology. The facility has been financially self-sufficient since its inception in 1961.



Five contracts were undertaken in 1984 for industrial and public sector clients. Three involved the transport of coal and two involved the pipelining of tailings from tar sand and gold mining operations. A sixth project involved heavy oil transport options. This project is being carried out, with consultants, under a contract to Saskatchewan Energy and Mines as part of the Canada-Saskatchewan Heavy Oil/Fossil Fuels Research, Development and Demonstration Program.

The transport of coal in pipelines represents a potential alternative for the movement of Saskatchewan's estimated recoverable coal reserves of seven billion tonnes to distant markets.

Saskatchewan has large ceramic clay reserves. Research continued on the removal of iron oxide to purify stoneware clays and bleaching of kaolin clays to increase its reflectance for use in paper and paint production. Success in this area would open a greatly expanded market for Saskatchewan clays. Currently, much of the clay used in paper coatings is imported from the USA.

SRC's Rock Mechanics Laboratory has, in conjunction with the University of Saskatchewan Geological Sciences Department, initiated a project under contract to Energy, Mines and Resources Canada to test the performance of our creep cell test equipment. This equipment is used to test large cores of potash and other soft materials, which provides valuable data for safer mining operations and maximization of ore recovery.

Mineral processing projects were undertaken on uranium tailings and liquid wastes. One involved the investigation of options for extracting gold from uranium tailings by leaching. Considerable amounts of gold are often found in uranium tailings, but some radioactive hazards exist in recovery. A second study investigated the removal of radium from uranium mine and mill waste waters by ion exchange. This is directed towards the amelioration of environmental hazards such as the transfer of radionuclides to lakes and streams and, subsequently, to the primary food chain through fish.

Both projects utilized SRC's Multi-Purpose Pilot Plant and were contracted by Melis Consulting Engineers of Saskatoon.

Energy Conservation

Saskatchewan took a commanding lead in residential energy conservation in the late 1970's, both in design specifications for new energy-efficient homes and in retrofit of houses. An estimated 200,000 Saskatchewan homes could benefit from retrofit. Saskatchewan has the highest energy requirement of any Canadian province for space heating purposes. Successes in this work, therefore, has the maximum benefit in Saskatchewan.

The program is now expanding into other building types including schools and recreational facilities. Draft standards have been prepared for Energy, Mines and Resources Canada on energy-efficient housing for the north, a new air washer design, effective removal of urea formaldehyde from houses and air-supported structures for recreational purposes in the north.

More than 30 reports were issued this year, including the Air-Vapour Barrier report, of which 10,000 copies have been distributed. Staff have also participated in several workshops and delivered keynote papers at numerous seminars.

Intensive aquaculture operations, such as cage-rearing of rainbow trout, call for aeration of pond water in the summer and for overwir tering. This SRC-developed aerator ensures adequate oxygen content.

Mineral Resources

The use of major and trace element patterns in bedrock to provide insight into the location of metallic and other mineral deposits takes on greater significance as these deposits become harder to discover.

Key components in this program are the number and location of samples, selection of elements and data analysis methods employed to detect anomalies destined to be drill targets. The cost of such a program represents a mere fraction of the cost of a major diamond drilling program to achieve similar results. Technical reports, scientific papers and seminars for exploration geochemists emphasize the development of basic methodology.

Research continued on the relationship between clay mineralization and the development of uranium mineralization in the Athabasca basin. This will contribute to the understanding of the development of the basin and its deposits. The X-ray powder diffraction facility was used extensively for the identification of clays and other minerals. Several mining firms are currently contracting with SRC for these services.

The development and application of computer graphics and computer assisted systems in data collection, analysis, and information transfer continued. Groundwater level record digitization from SRC's 50-well network continued and the feasibility of preparing open-file groundwater and geology maps by computer graphics is under investigation. Energy, Mines and Resources Canada sponsored a project to develop a micro-computer system to efficiently recover information on uranium tailings, which is nearing completion.

Sedimentary Geology

In early 1986 SRC is scheduled to publish the first 1:1 million Quaternary geology map of Saskatchewan, based on the current compilation of 1:250,000 maps. This compilation is identifying and delineating surface materials and landforms key to the future supply of groundwater, sand and gravel aggregate resources and the solution of geotechnical problems related to major building projects.

Drilling in support of this program was conducted near Regina, the Nipawin archaeological site and the Dalmeny groundwater research site.

A map defining useable aquifers, or water-bearing deposits, in the Saskatoon area was revised for publication in 1985. In co-operation with the University of Waterloo, a study was initiated to look into groundwater flow through tills. This is being conducted at Dalmeny, near Saskatoon.

We are answering the demand for sand and gravel aggregate resource information in the construction industry by compiling a series of 1:250,000 reconnaissance maps and, in high-demand areas, detailed 1:50,000 scale maps. Saskatchewan currently consumes nearly nine million tonnes of aggregate, valued at $23 million and the trend is for an increased consumption of 4% per year.

SRC maintains a 50-well network of observation wells, each providing coverage of a 5000 square kilometre area in the southern agricultural part of the province. The network provides both a continuous record of water level trends and changes and, through sampling; a systematic investigation of long-term water quality changes.

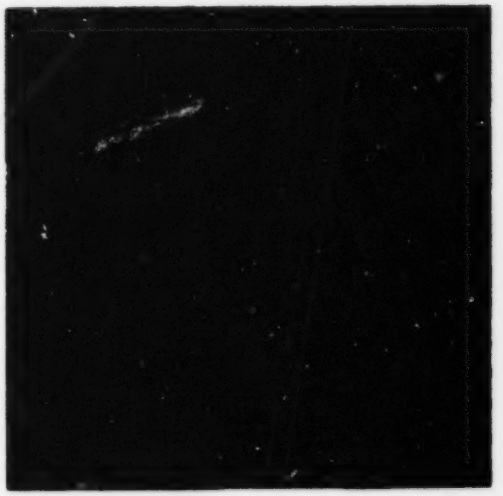
Biomass Resources

An annual saving of $3200 per farm was achieved by a farm energy management program in which many energy conserving practices were identified and demonstrated on 22 Saskatchewan farms. The three-year collaborative study involved agricultural engineers, private sector energy analysts, economists and SRC staff.

It was estimated that $80 million can be saved by Saskatchewan farmers by the universal application of fuel saving practices, such as "gear-up-throttle-down" tractor operation and the retrofitting of farm homes.

A potential for new farm income of up to $250 million could be realized by new farming methods employing efficient use of fuel and fertilizer. Deep banding of nitrogen fertilizer and minimum tillage methods to produce winter wheat yielded more grain for the same investment.

A project to grow edible oyster mushrooms (Pleurotus), funded in part by the NRC, found that good yields of marketable mushrooms could be achieved on simple straw substances.



Biofuels research was carried out to determine whether alcohol extraction of conventional forages and milkweed would yield whole plant oils which could be modified to provide useful fuels or fuel additives, such as octane enhancers and agents to make alcohol compatible with gasoline in gasohol.

Catalytic conversion methods of processing vegetable oils to give fuel additives showed promise and are under further investigation in collaboration with the University of Saskatchewan. Pretreatments and enzyme hydrolysis were used to break down forages to yield simple sugars suitable for fermentation to fuel alchol. Methods of recycling the expensive enzymes, required for hydrolysis, have been developed.

Collaborative studies with Agriculture Canada on kochia, a wild plant common on saline soils, gave forage yields of up to nine tonnes per hectare, presenting the potential for its use as an emergency cattle feed.

Saskatchewan has an abundance of suitable quality water with the proper temperature ranges for the production of rainbow trout. Traditional "put and take" fish farming in Saskatchewan can be supplanted by cage culture techniques, providing controlled growth and quality along with almost 100 per cent harvest.

Some 1.6 million pounds of rainbow trout are imported annually into Canada. There are 65 potential sites for the establishment of raceway systems in Saskatchewan. These could produce sufficient fish to make major inroads into the market.

One commercial, closed-system, recirculating hatchery has been established in the province and four more are under construction. These will help to meet a large potential market for fingerlings to supply fish farming operations and to stock Saskatchewan lakes and rivers for future sport fishing.

Saskatchewan Tourism and Small Business are funding the design of collection systems for these projects and investigations are underway concerning ventures into the export market.

We have also modified methods and equipment to measure oxygen, nitrogen and temperature for fish culture and rearing. Aeration and other equipment has been developed, resulting in a Saskatchewan company producing rearing and filter tanks, aerators, demand fish feeders and fiberglass raceways.

INDUSTRIAL TECHNOLOGY TRANSFER

... providing hands-on "shop floor" technical assistance, marketing and feasibility studies, industrial engineering counselling and delivery of the NRC Industrial Research Assistance Program to Saskatchewan's business and manufacturing sector.

Industrial Technology Transfer assists in Saskatchewan's economic development by providing the province's industry and manufacturers with expertise in Product and Process Development and Industrial Engineering/Management Consulting as well as delivery of the Industrial Research Assistance Program (IRAP) in Saskatchewan.

INDUSTRIAL ENGINEERING AND MANAGEMENT CONSULTING

This program provides industrial and management consulting services to government departments, private industry, crown corporations, municipal governments, and associations. The group endeavours to function in leading-edge technologies, and new consulting fields.

New client work this year includes Office Automation, Distribution Requirements Planning, and for several small companies, Manufacturing Resource Planning.

Consulting work continues that will facilitate the introduction and inplant use of micro-computers. The group has produced computer software for use in printing shop work scheduling, and plans to market the program, to the graphics industry throughout North America.

The group remains involved in overall productivity improvement strategies. A specific approach has been trademarked under the name "Cost Leadership". As a management strategy, Cost Leadership™ helps business produce products or services at a lower cost than competitors. In any market, the cost leader will be the most effective profitable competitor, maintaining the product's price and quality, but producing it at a lower cost.

With funding from the Saskatchewan Department of Tourism and Small Business, the Management Consulting group delivers the Product Development Management Program in Saskatchewan (PDMP). To date, approximately 30 manufacturers have been assisted in product development feasibility studies and business plans.

Two publications, "Technology Transfer" (quarterly) and "Management Insights" (bimonthly) continue to be published and directed to Saskatchewan's business and manufacturing sector. "Technology Transfer" has a circulation of over 4000; "Management Insights", 900.

The group sponsors and presents public and in-house seminars on topics that include Materials Management, Industrial Marketing, Cost Leadership™, Systems Design, Industrial Supervision, Time Management and CAD/CAM. During the year, five seminars have been held: two for the general public, and three in-house for companies and organizations.

INDUSTRIAL RESEARCH ASSISTANCE PROGRAM (IRAP)

This is a National Research Council (NRC) program, delivered by SRC's IRAP specialists. The purpose is to assist in the province's economic development by providing Saskatchewan industry with technological information, advice and guidance on industrial engineering methods and techniques, as well as access to relevant grant programs.

The IRAP/Saskatchewan program includes six elements:

IRAP—C– Field Advisory Service providing information and advice on industrial engineering methods and techniques. On request, industrial engineers will visit companies to directly assist in solving technical problems.

IRAP—F– provides a Technical Information Service of special interest to small companies with limited technical library facilities and/or engineering R & D staff. Solving problems through the application of the latest scientific and technical knowledge improves production, develops new products and redu-

Installation of prefabricated brick panels, manufactured by Pan-Brick Inc., Regina, who received product development assistance through various SRC-delivered IRAP elements including grants for standards approval.

ces costs. This is a free, confidential service.

IRAP—H– offers contributions to salaries of qualified engineering, science and technology students who can help small firms with production, manufacturing, product design, quality control and industrial engineering problems.

IRAP—L– provides financial assistance to small industries (less than 200 employees) allowing them to contract problem solving to research laboratories, institutes and consulting services. A company may receive 75 per cent of the costs, to a maximum of $6000 per project, for up to three projects per year.

IRAP—M– makes it possible for small companies to receive support for direct salaries of technical personnel working to solve specific problems, to a maximum of $30,000 over one year. The program can also put together a professional research team to work with the company on technical problems.
Eligible projects must emphasize applied research and development in the physical, chemical and biological fields, establishment of design principles for a new product or process through preliminary engineering, or process and product development or improvement by establishing technical feasibility. Day-to-day operations such as quality control, marketing, operations research, routine testing or modifications to plant operations are items not usually eligible for IRAP—M support.

IRAP—P– is aimed at longer-term projects of high technical merit. The original IRAP program, IRAP—P maintains its role as the major assistance program to industry for applied research projects spanning two to three years.

Approval for IRAP programs is given on a competitive, discretionary basis as available funding permits. Factors affecting selection include the possibility of a project leading to a significant technological advance, providing benefit to both industry and people.

During 1984, IRAP/Saskatchewan specialists made nearly 1800 visits to provincial industrial and manufacturing plants. Thirty-six hundred inquiries were handled, with only 24 being referred back to NRC, Ottawa. IRAP—H involved over 30 student projects, while IRAP—L involved a similar number of laboratory investigations.

IRAP—M was instrumental in launching eight new projects, while IRAP—P saw two new projects underway.

IRAP—C's 1700 clients cover the province from Estevan to Uranium City, Swift Current to Hudson Bay.

In January, 1984 we opened a Regina office to more effectively deliver the IRAP Programs to our many clients in southern Saskatchewan. Initial response has been excellent, bringing an additional 100 inquiries and field visits per month onstream.

PRODUCT AND PROCESS DEVELOPMENT PROGRAM

The Product and Process Development Group exists to assist industrial clients develop and improve their products through the effective use of Computer-Aided Design, Computer-Aided Manufacturing (CAD/CAM), and related technologies. CAD/CAM offers the potential to increase productivity, improve quality and enhance the technical capabilities of designers, while optimizing processes, materials control, methods and manpower. The real benefits to Saskatchewan industry include:

- advanced prototype design
- cost and time savings for prototype modification
- easier, faster, cheaper assembly
- accurate prediction of structural response to working conditions and stresses
- typically, at least a three-fold increase in over-all productivity.

The delivery of CAD/CAM benefits to Saskatchewan industry took a positive step forward this year with the opening of the Saskatchewan CAD/CAM Robotics Centre at SRC. This Centre will be funded, in part, by a $2.47 million contribution from the Federal Department of Regional and Industrial Expansion, over the next five years.

The Saskatchewan CAD/CAM Robotics Centre will provide a new, direct approach to the transfer of this technology. Functioning CAD/CAM design stations will be placed in manufacturing plants throughout the province, and will be linked to the data processing resources of the

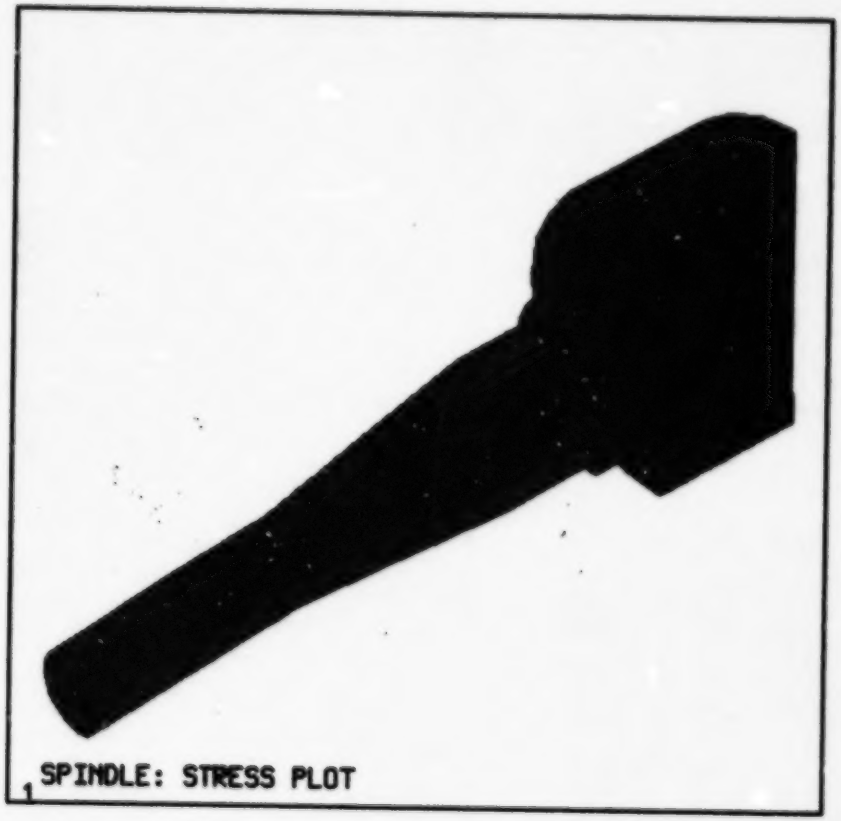
CAD/CAM technology not only provides design capability, but can also allow manufacturers to test their designs without the expense of a prototype. A stress plot, as shown here, provides valuable information on the performance of a part.

CAD/CAM Robotics Centre in Saskatoon. SRC will provide consultation and on-site training services. This approach is particularly suited to clients' needs in Saskatchewan, where many of the province's manufacturers operate small plants, often in rural areas.

The Product and Process Development group's work with Saskatchewan manufacturers can be measured in real dollar value terms. Thirty-three projects this year resulted in estimated development cost savings totalling $695,000. These figures reflect five types of projects:

Beckie Hydrogeologists Ltd., Regina
($275,000 estimated development cost saving).

- 5 Product Analyses (II)
  ($110,000 estimated development cost saving).
- 4 Product Engineering projects
  ($80,000 estimated saving).
- 3 Systems Engineering projects
  ($50,000 estimated saving).
- 5 New Technology Development projects
  ($180,000 estimated saving).

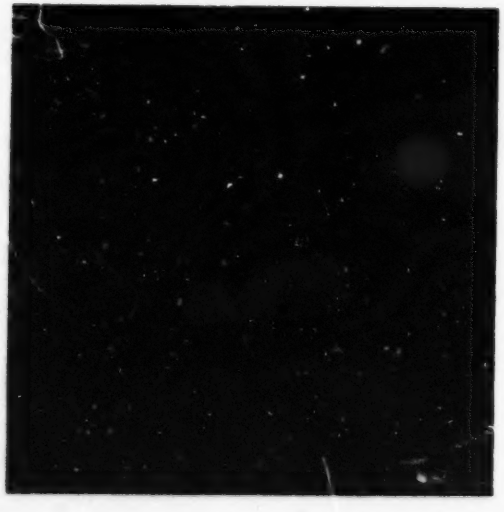


ENVIRONMENT

... providing research on the maintenance, management and improvement of the biophysical environment and the impact of present and future industrial activity, transportation and other major developments on that environment.

Programs in this sector focus on specific environmental concerns in this province, as well as those which are of a more global nature.

Water, a primary element for human existence, is covered under the Surface Hydrology and Aquatic Biology programs while problems relating to the land are the concern of the Terrestrial Ecology group. Atmospheric Processes deals with ambient weather, acid precipitation, air quality and industrial pollution. As well, the preservation of our heritage, through archaeological studies prior to megaprojects such as dams, pipelines and transportation routes is the responsibility of the Archaeological Program.



Painstaking work by archaeologists provided a key to unlock Man's past heritage. SRC's Carol Beaulieu carefully unearths bone fragments at the future site of the Nipawin Hydroelectric Dam.

SURFACE HYDROLOGY

Research is targeted at the identification of present and potential problems related to quantity and quality of Saskatchewan surface water, development of process knowledge and management alternatives, and development of environmental monitoring equipment specific to the needs of this province as well as national and international clients. The program is partially core-funded, as well as contract-funded, and provides essential hydrologic and remote sensing input into environmental impact studies, for mining and hydroelectric developments.

The Grand River Conservation Authority in Ontario contracted SRC to build two water quality monitoring stations to collect and store digital data, dial the information at selected times and transmit emergency situations in voice to a selected set of telephone numbers.

The program also provides system design for other SRC programs, particularly Aquaculture, Energy Conservation and Atmospheric Processes.

AQUATIC BIOLOGY

Industries operating in the province must meet requirements established by Saskatchewan Environment for environmental protection, with respect to predevelopment environmental impact assessment, post development monitoring, decommissioning and reclamation.

SRC maintains a multidisciplinary team of experts to assist industry and government in research relevant to environmental protection. In recent years we have directed our efforts to research that facilitates the impact assessment process. Extensive studies have been undertaken in water quality, radionuclides (radioactive contaminants) in the environment, and mine site reclamation.

Within Saskatchewan, we have monitored surface water and groundwater to identify changes to the Saskatchewan River during the construction phases of the Nipawin Hydroelectric Project. Both river water samples and samples from deep wells have been obtained on a regular basis and analysed for major ions, nutrients, heavy metals and general physical properties.

SRC provides the Saskatchewan representative to the Prairie Provinces Water Board's technical committee on water quality, which meets regularly to assess the water quality of eastward-flowing interprovincial rivers, exchange information and develop site-specific water quality requirements at provincial boundaries.

We also provide a water quality specialist's services to review technical documents, water quality and related information in order to provide Environment Saskatchewan with reports and recommendations, as requested. An example of this service was the "Cold Lake-Beaver River Water Quality Management" study.

Research continues regarding uranium mining activities in the northern part of the Province and their effects on the lake and stream sediments through radionuclide deposition.

We are well into studies to sample components of the primary food chain at the former mine and mill sites at Eldorado and Gunnar. The studies will enable calculation of transfer coefficients, further clarify uptake rates, and help predict possible consequences of flooding other open pits. The

data will provide invaluable assistance in the decommissioning of present and future mine sites.

Further benefits will be a greater understanding of the movement of contaminants in food chains in general and, in particular, radionuclide transfer in a confined, unambiguous food chain leading to the northern pike, a mainstay of Saskatchewan's commercial and sport fishing industry.

Not only do radionuclides affect the food chain, but there is reason to believe that they may be a significant factor in fish parasitology and other abnormalities in fish, aquatic biota, vegetation and bottom-dwelling invertebrates.

Studies are being conducted to compare levels of parasitism in fish in Beaverlodge Lake (with its elevated radionuclide levels) to two control lakes. Fish blood-forming tissues are being examined for abnormalities such as lesions and parasites, through routine postmortems. Innovative techniques for fish blood sampling and cell identification are also being utilized.

A computer data base on uranium radionuclides in aquatic biota will permit statistical analysis of available data on radionuclides in aquatic plants, invertebrates and fish in northern Saskatchewan. As well, SRC has initiated studies to compare levels of radionuclides in several selected species of lichens, mosses and higher plants.

TERRESTRIAL ECOLOGY

Since the early 1930's, strip mining of coal in the province, particularly in the Estevan area, has resulted in 7000 hectares of disturbed land. This is increasing at a rate of 250 hectares per year. Revegetation of both sodic and non-sodic coal spoils has been a major topic for study.

Reclamation of the spoil areas for productive agricultural use in the Coronach area and for rangeland in the Estevan area requires definition of suitable plant species and soil amendments to improve seedling emergence, establishment and productivity.

Soil amendments investigated have included leonardite and bottom ash (byproducts of coal mining and consumption), gypsum, calcium, chloride, hay and straw. Intermediate wheatgrass, meadow brome, tall wheatgrass, altai wildrye and alfalfa were considered most suitable for the Estevan area, while at Coronach, where a 10 cm topsoil layer was placed on non-sodic material, crested wheatgrass, altai wildrye and Russian wildrye did best.

The potential for molybdenosis, an animal nutritional imbalance has been considered and, although Cu:Mo ratios are below the 5:1 ratio at or below which molybdenosis has been reported to occur, selection of plant species for revegetation should be carefully considered.

SRC has also identified the need for standardizing environmental sampling and analysis methodologies for considering the impact of present and potential developments in a regional context. A study for SMDC has provided specific recommendations for improving future environmental baseline and monitoring studies pertaining to aquatic, terrestrial, atmospheric and socio-economic components of the environment.

Herbicide application is an effective method of land clearing for industrial right-of-way development, including powerlines. However, improved methods are needed to avoid unnecessary damage to adjacent areas. We have examined the natural vegetation pattern following the application of "Tordon" herbicide to a powerline right-of-way. Grasses and grass-like plants became most prevalent following the disappearance of most broad-leafed species in the sprayed area. No conclusive evidence of Tordon movement within the soil was found.

Thousands of hectares in southern Saskatchewan, disturbed by coal mining activity, require reclamation to return them to a productive state. Bob Godwin samples vegetation on a reclaimed coal spoil near Estevan.

ATMOSPHERIC PROCESSES

Over the past three decades, SRC has maintained a comprehensive weather data gathering system, providing valuable information to industrial, agricultural and media interest.

The program also involves the study and classification of the behaviour of atmospheres. It involves the establishing of a long-term guide of weather parameters; monitoring air pollution in the form of acid precipitation or ambient herbicides in the atmosphere; modelling the short—and long-term dispersion of pollution within the atmosphere; and, on a contract basis, sampling stack gas emissions for provincial industries.

Air quality studies are conducted in a variety of environments, including agricultural machinery, mine and industrial sites, office buildings, hospitals and schools. These contracted studies involve investigation of suspected occupant exposure to harmful agents, as well as the testing of monitoring equipment. Studies have also been conducted on a joint basis with the U. of S. Department of Social and Preventive Medicine, involving uranium mining activites.

A project is also underway to test Canola Oil as an efficient spray carrier for ultra-low volume application of herbicides.

Acid precipitation is a major concern throughout the world. In Saskatchewan, interest has been focussed on the northern part of the province, where SRC has mounted a program of sampling snow and rain for acid depositon. Major ion chemistry is used to evaluate the impact of such precipitation.

ARCHAEOLOGY

Saskatchewan possesses a diversity of geographic features which has provided a home for many early cultures. Much of our heritage rests with the unearthing and documentation of their existence, often before the evidence is lost forever to modern day developments.

SRC's archaeologists maintain an active program of field site excavations and laboratory analysis to record evidence of human habitation of our province in historic and prehistoric time periods.

Two dominant projects involved the SPC Nipawin hydroelectric development and a study of the Laurel Culture in northern Saskatchewan.

At Nipawin, evidence has been uncovered of human habitation over the past 6000 years ranging from the Grant-McLeod fur trading post circa 1793-95, back to a Mummy Cave period occupation circa 5,500 years ago.

Painstaking excavation has uncovered numerous artifacts. Examples are: pottery and bone tools from A.D. 1500-1700 (Pehonan) and A.D. 40 - 900 (Avonlea), as well as projectile points from the Pelican Lake period (circa 510 B.C.) and the McKean period (circa 2500 B.C.). All artifacts found have been analysed, documented and preserved to add to our growing Saskatchewan Heritage.

Laurel Culture, with its distinctive pottery, has been noted in collections from 31 sites in the northeastern forest area of the province. It represents the most northwesterly extremity of a huge area of forests in Manitoba, Ontario and Minnesota in which Laurel peoples lived between 100 -900 A.D.

SERVICES

... providing client services in Analytical Chemistry and Geochemical Analyses, as well as Council-wide internal services.

Exploration for Saskatchewan's gold resources is employing new technology involving the ashing and analysis of vegetation for traces of gold absorbed in plant growth. Geochemical technician Steve Cutts prepares samples for Atomic Absorption analysis.

The Services Sector provides internal and external services as detailed below.

ANALYTICAL SERVICES

Industrial, environmental, and research clients contract chemical analyses from our Analytical Laboratory, located in the Resources Research Centre, Innovation Place, Saskatoon.

Operations are subdivided into Water Chemistry and Radiochemistry, handling samples such as water, soil, sediments, fish, tissue, vegetation, coal, oil, fuel, and chemicals. Instrumentation ranges from chromatographs and spectrographs to a SLOWPOKE nuclear reactor for neutron activation analyses.

Seventy per cent of the analyses involve environmental monitoring samples such as water, soil, vegetation, sediment and, occasionally, wildlife. Samples are analysed for major and trace element constituents including herbicides, pesticides, and trace metals. 15,000 samples were analysed in 1984.

Analytical research is a support function which develops new areas of analytical expertise, new methods to meet special and analytical requirements, and new instrumentation to automate or improve analytical operations.

The uniqueness of the SLOWPOKE II nuclear reactor and the plasma-emmission spectrometer enables joint projects with university researchers to develop improved methods of trace element analysis in a wide range of studies. The ongoing development and improvement of analytical methodology through analytical research has maintained the laboratory at the leading edge of radiochemical and analytical services in Canada.

GEOCHEMICAL SERVICES

Saskatchewan's mining exploration industry requires a wide variety of geochemical analyses of rocks, ores, minerals, sediment and vegetation samples to assist in directing the course of field exploration.

Geochemical Services provides fast, reliable, economical, high-volume geochemical analyses. We work closely with the mining exploration industry to provide research in the development of new analytical techniques, aimed at improving Saskatchewan mining exploration. The service is a key component in other SRC projects in the resources field.

The facility has grown over the past 11 years into a modern, up-to-date analytical laboratory with a high degree of automation and computerization. This results in reliable, productive and flexible service, particularly to major clients such as: SMDC, Uranerz, Eldor Resources, Key Lake Mining, Sask Oil, and Sask. Energy and Mines. Many smaller-scale clients and individuals utilize the service, which processed 17,000 samples this year.

RADIOCARBON DATING

The determination of the ages of specimens, up to 33,000 years old, of geographic, geological and archaeological interest, can be accomplished by measuring the amount of radioactive carbon-14 isotope present in carbonaceous materials. Since 1958, SRC has supplied this valuable service to many scientific investigators.

The process involves sophisticated, low-level radioactive counting techniques which are required to accurately detect and measure the extremely small amounts of the isotope present. Annually, about 150 samples of once-living material are processed for Saskatchewan clients, as well as for the prairie provinces and the Museum of Man in Ottawa.

GRAPHICS SERVICES

This unit provides specialized graphics communication services involving cartography/drafting, photography/photomechanics, audio-visual and display presentations to all SRC programs and clients.

The program maintains a complete map/air photo library of the province, which provides a valuable resource for our clients and for SRC. The library is complemented by a unique 1:50,000 air photo mosaic collection covering Saskatchewan and its immediate bordering areas.

The Senior Graphics Technologist from this unit serves on the Advisory Board of the Saskatchewan Technical Institute's Drafting and Survey Technology Course.

Attached to the Graphics Services program is an in-house Copy Centre, providing electrostatic copying services, binding and other report production services.

A group of Saskatchewan Earth Sciences teachers, sponsored by the Saskatchewan Mining Association, were shown scribing and color separation techniques used in preparing maps and publications by Graphics Manager Carlos Sardinha, during a tour of SRC facilities.

SHOPS

This program is staffed by five tradespeople skilled in areas required for the maintenance of SRC facilities and equipment. They also provide services in the design, fabrication and/or assembly of specialized equipment required by SRC programs.

CORPORATE/ FINANCIAL SERVICES

Accounting, Purchasing, and Stores functions are performed under the direction of the Controller, while Library, Stenographic and Personnel functions are included in Corporate Services. As well, SRC employs the services of a full-time Safety Officer.

CANADIAN CENTRE FOR ADVANCED INSTRUMENTATION (CCAI)

... an internationally recognized resource centre for advanced instrumentation, providing design services and technical support to high technology users of measurement and control instrumentation.

This centre exists to improve efficiency, effectiveness and quality in industry, government and education through the use of measurement and control instrumentation. CCAI aims to be internationally recognized as a resource centre for instrumentation. The centre is partially funded by a contribution from the federal Department of Regional Industrial Expansion.

In the past year the centre solved instrumentation-related problems for approximately 70 clients. While the majority of these clients were Saskatchewan-based, some were from other provinces as well as other countries including the United States, India and Madagascar.

A major project was completed for the Canadian Department of National Defence — the design and development of a prototype air sampling system. This system, when fully implemented, will save the Department hundreds of thousands of dollars over the lifetime of the system. In addition, it is anticipated that CCAI will spin-off a commercial version of the system to measure such things as work-place air quality, herbicide drift and effluents from industrial processes.

An acid rain collector was developed for a company in Sacramento, California. The American firm will manufacture and market the collector in the United States while CCAI retains the Canadian market rights.

Several projects were completed for the agricultural industry. A feasibility study for a farm implement manufacturer demonstrated the inadvisability of proceeding with a major research and development project thereby saving the company a capital expense. A second feasibility study for another farm implement manufacturer subsequently led to a federal government contract, for that company, to develop and incorporate a control system in one of its products. A product evaluation for a third manufacturer resulted in an improved product, while CCAI was able to assist a fourth manufacturer to study crop spraying patterns. This study was facilitated by the design of a mold and subsequent manufacture of several hundred plastic wheat plants. The result of this experiment was to improve the design of the manufacturer's crop spraying equipment.

CCAI continues to provide service to the Saskatchewan uranium industry through on-going maintenance and calibration of commercial safety-related instruments. In addition, the centre developed an automated sample changer, used in ore analysis, for a major mining company. By automating the analysis process, significant savings in labour costs were realized.

A process controller, to interface with an economical personal computer, was developed for a Crown Corporation resulting in considerable cost saving over an equivalent industrial controller. Several of these units were subsequently supplied by CCAI.

This CCAI-developed Minitube Air Sampling System, with carousel containing 50 minitubes for sample collection is fully automated and programmable to the specific needs of the user/client.

FINANCIAL STATEMENTS

For the Year Ended March 31, 1984

SASKATCHEWAN RESEARCH COUNCIL FUND

AUDITOR'S REPORT

To the Members of the Legislative Assembly
Province of Saskatchewan

I have examined the balance sheet of the Saskatchewan Research Council Fund as at March 31, 1984 and the statements of revenue, expenditure and fund balance and changes in financial position for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1984 and the results of its operations and the changes in its financial position for the year then ended in accordance with the stated accounting policies applied on a basis consistent with that of the preceding year.

Regina, Saskatchewan
June 26, 1984.

W. G. Lutz, F.C.A.,
Provincial Auditor.

SASKATCHEWAN RESEARCH COUNCIL FUND
BALANCE SHEET

Statement 1

As At March 31

	1984	1983
ASSETS		
Current assets:		
Accounts receivable	$1,998,833	$1,822,876
Prepaid expenses	40,874	48,210
	$2,039,707	$1,871,086
Fixed assets (Note 3)	1,367,616	1,672,754
Other assets	3,939	3,939
	$3,411,262	$3,547,779
LIABILITIES AND FUND BALANCE		
Current liabilities:		
Bank indebtedness	$1,064,772	$ 610,573
Research grants payable	103,297	117,652
Accounts payable	600,413	471,165
Employee deductions payable	170,974	195,258
Retroactive salaries payable	—	199,881
Deferred revenue (Note 6)	143,414	332,833
Current portion of conditioned sales contract (Note 5)	—	91,862
Vacation and benefits payable (Note 8)	89,421	284,490
	2,172,291	2,303,714
Long term liabilities:		
Conditional sales contract (Note 5)	—	102,866
Deferred revenue (Note 6)	380,928	460,956
Fund balance — Statement 2	858,043	680,223
	$3,411,262	$3,547,779

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND

STATEMENT OF REVENUE, EXPENDITURE AND FUND BALANCE

Statement 2

Year Ended March 31

	1984	1983
Revenue:		
Contracts	$ 6,048,050	$ 6,282,028
Grant - Government of Saskatchewan	3,876,060	3,518,830
Interest	46,461	—
Other (Note 6)	338,324	301,497
	10,308,895	10,102,355
Expenditure:		
Salaries	5,940,602	6,386,294
Employee benefits	757,991	602,690
Supplies and technical services	1,771,622	1,682,610
Depreciation	416,457	481,857
Travel and vehicle operations	192,278	269,158
Rent and utilities	511,383	375,009
Research grants	103,297	117,652
Other	437,445	417,639
	10,131,075	10,332,909
Excess of revenue over expenditure (expenditure over revenue)	177,820	(230,554)
Fund balance, beginning of year		
As previously reported	680,223	1,285,193
Adjustment due to change in accounting policy (Note 8)	—	(374,416)
Fund balance, beginning of year, as restated	680,223	910,777
Fund balance, end of year — to Statement 1	$ 858,043	$ 680,223

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND
STATEMENT OF CHANGES IN FINANCIAL POSITION

Statement 3

Year Ended March 31

	1984	1983
Source of funds:		
From operations		
Excess of revenue over expenditure (expenditure over revenue)	$ 177,820	$(230,554)
Add (deduct) charges (credits) not involving a flow of funds:		
Depreciation	416,457	481,857
Reduction in long term portion of deferred revenue	(80,028)	(84,671)
Loss on disposal of fixed assets	16,226	—
Proceeds from sale of fixed assets	21,068	—
Total source of funds	551,543	166,632
Application of funds:		
Increase in other assets	—	7
Reduction of conditional sales contract	102,886	91,862
Purchase of fixed assets	148,613	338,616
Total application of funds	251,499	430,485
Increase (decrease) in working capital	300,044	(263,853)
Working capital deficiency, beginning of year	(432,628)	(168,775)
Working capital deficiency, end of year	$(132,584)	$(432,628)

(See accompanying notes to the financial statements)

SASKATCHEWAN RESEARCH COUNCIL FUND
NOTES TO THE FINANCIAL STATEMENTS
March 31, 1984

1. Summary of Accounting Policies

(a) Revenue Recognition

Grant revenue is recognized in the accounts as moneys are appropriated by the legislature for the purpose of The Research Council Act.

Revenue from the majority of contract work is recognized on the percentage-of-completion method which recognizes revenue as a contract progresses. Unbilled revenues are accrued to the year end for these contracts, while pre-billed revenues are classified as deferred revenue.

Revenue from analytical lab work, involving shorter term contract without substantial outlays of direct costs, is recognized on a completed contract basis.

(b) Fixed Assets

The assets of the Fund are initially recorded at cost, including labour, material and overhead for self-constructed assets.

Depreciation is provided over the estimated useful lives of the assets on the following bases:

(i) Sum of the years digits method

Buildings	20 years
Leasehold improvements	5 years
Equipment	10 years

(ii) Declining balance method

Automotive	33 1/3%

(c) Pension Costs

The Council participates with its employees in a benefit based pension plan and, in accordance with recommendations of the Plan's actuary, contributions to the Plan by the Council are made in amounts necessary to fund benefits accruing for current service and to fund past service benefits, if any, over reasonable time periods. The cost of funding the Pension Plan on the basis recommended by the actuary is reflected in these statements to the extent of contributions made to the Plan in each year.

(d) Research Grants

Research grants awarded annually by the Council to aid in funding approved research projects are charged to expenditure in the year in which costs are incurred on the projects.

(e) Occupancy Costs

Certain buildings have been built for the use of the Council by the Government of Saskatchewan at no cost to the Council. No provisions for such costs is reflected in these financial statements.

2. Authority

The Saskatchewan Research Council Fund was established pursuant to Section 15(1) of The Research Council Act. The Fund is administered by the Saskatchewan Research Council for the purpose of research and investigation in the fields of the physical sciences, pure and applied, as they affect the economy of the Province of Saskatchewan.

3. Pension Plan — Actuarial Valuation

An actuarial valuation of the Plan as at December 31, 1983 indicated that the Plan was fully funded as at that date with a surplus of $315,144 determined by the accrued benefit actuarial cost method.

The Council is following the actuary's recommendation that the Council contribute 95.9% of members' contributions after December 31, 1983 in respect of current service and until the next review of the Plan. No further past service payments by the Council are required.

The next actuarial valuation is required to be performed as at December 31, 1986.

4. Fixed Assets

	1984			1983
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Buildings	$ 563,973	$ 317,706	$ 246,267	$ 282,225
Leasehold Improvements	418,334	407,597	10,737	29,149
Equipment	3,077,262	2,024,580	1,052,682	1,296,133
Automotive	262,886	215,956	46,930	54,247
Land	11,000	-	11,000	11,000
	$4,333,455	$2,965,839	$1,367,616	$1,672,754

5. Conditional Sales Contract

The Council entered into a conditonal sales contract in 1980 with Atomic Energy of Canada Ltd. for the purpose of equipment in the amount of $401,305. The contract provided for a $51,305 down payment and four annual instalments including interest at 12%. At March 31, 1983, the remaining instalments were as follows:

Due Date	Principal
July 1, 1983	$ 91,862
July 1, 1984	102,886
	$194,748

During 1983-84 the contract was paid out in its entirety.

6. Deferred Revenue

The Fund has deferred revenue of $460,956 from the Potash Corporation of Saskatchewan for prepaid rent of a pilot plant. The revenue is being reflected in the accounts by the sum of the years' digits method over the 10 year term of the agreement which commenced in the 1981-82 fiscal year. The current portion of this deferred revenue is $80,0238 and is classified accordingly on the balance sheet while the amount of revenue included in other revenue in the current year is $84,671 (1983 - $89,315).

7. Related Party Transactions

Related parties to the Council are Saskatchewan's crown controlled departments, agencies and corporations. Transactions with these parties are recorded at normal market prices except for certain buildings built for the Saskatchewan Research Council's use by the Government of Saskatchewan at no cost to the Council as explained in Note 1(e).

8. Change in Accounting Policy

During 1983, the Council retroactively changed its accounting policy respecting accrued vacation credits carried over. Previously, the accrued vacation credits had been expensed when they were either utilized or paid out. Under the new policy, the Council recognized the cost when the vacations are earned. This change in policy resulted in a decrease in equity as at the beginning of 1983 of $374,416.

9. Funding of Retroactive Pay

The Council received approval in 1983 of a request for additional funding of up to $111,000 related to retroactive salaries paid for the period October 1, 1982 to December 31, 1982. Receipt of this amount from the Consolidated Fund was contingent on factors which could not be evaluated until the end of the 1983-84 fical year. In the 1983-84 year, a supplementary amount of $111,000 was appropriated and paid to the Fund and is included in grant revenue from the Province of Saskatchewan in accordance with the revenue recognition policy outlined in note 1(a).

GRANTS-IN-AID 1983-84

Since its creation in 1947, the Saskatchewan Research Council has provided grants to applicants in Saskatchewan universities for applied research in the sciences. Twelve ongoing projects were allocated $76,000, six new proposals received $34,500, and 13 University of Saskatchewan projects received $75,900.

The following projects are presently receiving support under the grants-in-aid program:

UNIVERSITY OF SASKATCHEWAN

Department of Agricultrual Engineering
J.A. Gillies; J.M. Murray
Artificial recharge of groundwater.

Department of Applied Microbiology and Food Science
G.A. Jones; W.M. Ingledew
Production of ethanol and other liquid fuels from biomass by syntrophic fermentation.

Department of Chemistry
R.J. Woods
Neutron activation analysis of trace elements in soil.

Department of Civil Engineering
D.G. Fredlund
Use of filter paper to measure matric suction for geotechnical purposes.

Department of Civil Engineering
E.K. Sauer
Hydrogeology of till deposits in Saskatchewan.

Department of Crop Science and Ecology
E.A. Ripley
Modelling wheat growth and development.

Department of Geological Sciences
L.C. Coleman; M.R. Stauffer; E.G. Nisbet
Further geochemical studies of Flin Flon volcanics.

Department of Geological Sciences
H.E. Hendry
Petrology and diagenesis of the Athabasca group, northern Saskatchewan.

Department of Home Economics
A.K. Summer
Effect of immaturity and harvesting method on cereal crop quality.

Department of Horticulture Science
C. Stushnoff; A.R. Olson
Influence of low temperature stress on fruit set in Saskatoon berry.

Department of Mathematics
D.W. MacLean
Optimization of log breakdown patterns in sawmills.

Department of Physics
K.V. Paulson
The development of the magnetotelluric method for resource exploration in Saskatchewan.

Department of Soil Science
P.M. Huang
The nature and properties of current and potential acidity of soils in Saskatchewan.

UNIVERSITY OF REGINA

Department of Biology
M.V.S. Raju; W.A. Quick
Morphological and biochemical studies on induction of dormancy in developing caryopses of Avena fatua (wild oat).

Department of Chemistry
K.E. Johnson
Chemical studies of acid rain impact.

Department of Engineering
J. Mozel
CAD/CAM service and research centre.

Department of Geology
G.R. Parslow
Trace elements (particularly base metals of economic interest) in the Flin Flon volcanics.

Regional Systems Engineering
F.A. Curtis
Transportation energy modelling in subdivisions: Year 2.

SCHOLARSHIPS

The Government of the Province of Saskatchewan offers graduate research scholarships, tenable at either the University of Saskatchewan or the University of Regina. The purposes of the awards are to assist graduate students to prepare for careers in scientific and industrial research, and to create interest in the exploitation of Saskatchewan's resources and in techniques that will advance the development of the Province. SRC conducts the selection of the candidates.

Awards valued at $8,200 for the year beginning May 1, 1983 were made to:

Michael J. Bidochka, Biology Department
University of Regina

Karen S. Bolton, Geography Department
University of Regina

Frederick Frankling, Crop Science Department
University of Saskatchewan

The Saskatchewan Research Council serves some 2000 clients in Saskatchewan, Canada, and throughout the world. Some of these are:

Zenon Park Co-op, Zenon Park
Conservation Energy Systems, Saskatoon
Palm Dairies Limited, Saskatoon
Ifrascan Resource Technology, Prince Albert
Brandt Industries Limited, Regina
Flexicoil Limited, Saskatoon
Leon's Manufacturing, Yorkton
Morris Rod Weeder Company, Yorkton
Shulte Industries, Englefeld
International Minerals Corporation, Esterhazy
Prince Albert Pulp Company, Prince Albert
Rem Industries, Swift Current
Westank Industries Limited, Regina
Lux Industries, Humboldt
Lorne's Welding, Hudson Bay
Metal Fabricating Limited, Esterhazy
Beeline Welding Limited, Prince Albert
Westank-Willock, Saskatoon
Saskatchewan Telecommunications
SEDCO
Sask. Department of Supply and Services
Empire Meats, Saskatoon
Eldor Resources Limited
Dow Chemical Canada Inc.
Department of National Defence
University of Saskatchewan
Saskatchewan Power Corporation
Environment Canada (Water Quality Branch)
Qualimetrics, Sacramento, California
Safety Supply Canada Ltd., Saskatoon
Potash Corporation of Saskatchewan
Uranium Corporation of India
W.A. Meneley Consultants, Saskatoon
Cluff Mining, Cluff Lake
Venables Machine Works, Saskatoon
Northern Telecom, Saskatoon
Kalium Chemicals, Belle Plain
Cominco Potash Ltd.
Blumhardt Manufacturing Company, Manitoba
University Hospital, Saskatoon
Saskmont Engineering, Regina
Grand River Conservation Authority, Ontario
Saskatoon Chemicals, Saskatoon
Sask. Government Employees Union
Amok Limited, Saskatoon
Atomic Energy of Canada Limited
City of Saskatoon
Beckie Hydrogeologist Ltd., Regina
Clifton Associates Ltd., Saskatoon
Hardy Associates Ltd., Calgary
Husky Oil Operations Ltd., Lloydminster
Key Lake Mining Corporation, Saskatoon
Millar Western Industries, Palo
Senes Consultants Limited, Willowdale, Ontario
Saskatchewan Mining Development Corporation
Energy, Mines and Resources
Agriculture Canada
Saskatchewan Energy and Mines
Saskatchewan Industry and Trade
National Research Council
Transport Canada
Techman International Ltd., Calgary
Melis Consulting Engineers, Saskatoon
Canadian International Development Agency

Staff of the Saskatchewan Research Council are very active in community affairs and professional societies. A partial list includes:

Community Involvement

Advanced Technology Training Centre Advisory Board
Wakamow Valley Authority Advisory Board
Meewasin Valley Authority Advisory Board
Kelsey Institute Advisory Board
Saskatchewan Technical Institute Advisory Board
Saskatoon Archaeological Society
Saskatchewan Archaeological Society
Big Sisters
International Christian Bikers Association
Boy Scouts of Canada
Canadian Association of Disabled Skiers
Saskatoon Board of Education
Saskatchewan Golf Association
India-Canada Cultural Association
Saskatoon Multicultural Council
Saskatoon Natural History Society
Saskatoon Nordic Ski Club
Saskatoon Press Club
Canada Safety Council
Sasksport
Saskatoon East School Board
Saskatoon Ski Club
Saskatchewan Sports Hall of Fame
Lutheran Student Centre
Saskatoon Symphony Society
Suzuki Talent Education Program
Saskatchewan Track & Field Association
Canadian Track and Field Association
Saskatoon Board of Trade
Saskatchewan Wood Workers' Guild

Professional Societies

Society of Management Accountants
Canadian Aeronautics and Space Institute
Aerosol Research Association
Air Pollution Control Association
Canadian Air Cushion Technology Society
Agricultural Institute of Canada
Canadian Archaeological Association
Society of Automotive Engineers
North American Benthological Society
Institute of Chartered Cartographers
Canadian Ceramic Society
Canadian Society of Chemical Engineers
Chemical Institute of Canada
American Institute of Constructors
North American Society for Corporate Planning
Construction Specifications Canada
American Institute for Design and Drafting
Creative Education Foundation
Institute of Electrical and Electronic Engineers
Association of Professional Engineers of Saskatchewan
Society of Engineering Technicians and Technologists of Saskatchewan
Canadian Ethnological Society
Institute of Environmental Sciences
Canadian Institute of Food Science and Technology
Canadian Association of Geographers
International Association for Mathematical Geology
Geological Association of Canada
American Geophysical Union
International Glaciological Society
Canadian Society of Hospital Engineering
Housing and Urban Development Association of Canada
International Association of Hydrogeologists
Canadian Information Processing Society
Institute of Industrial Engineers
American Industrial Hygiene Association
Instrument Society of America
American Society of Limnology and Oceanography
Society of Manufacturing Engineers
American Marketing Association
American Society of Metals
Canadian Meteorological and Oceanography Society
Royal Meteorological Society
Canadian Institute of Mining and Metallurgy
Canadian Occupational Health Association
Society of Plastics Engineers
Canadian Association of Physicists
Purchasing Management Association of Canada
Canadian Quaternary Association
Canadian Remote Sensing Society
Association of Provincial Research Organizations
Canadian Research Managers Association
American Society of Safety Engineers
Spectroscopy Society of Canada
Technology Transfer Society
University of Saskatchewan Faculty
International Water Resources Association
Canadian Water Resources Association
Water Studies Institute
National Water Well Association
Welding Institute of Canada
Canadian Society of Zoologists

SASKATCHEWAN RESEARCH COUNCIL MEMBERS

Mr. Gordon C. Birney
CHAIRMAN, Saskatchewan Research Council
Partner, Birney & Smith, Chartered Accounts, Saskatoon.

Dr. Alex J.Y. Guy
VICE-CHAIRMAN, Saskatchewan Research Council, Deputy Minister of Sask. Science and Technology, Regina.

Mr. Jim Hutch
SECRETARY, Saskatchewan Research Council, President, Saskatchewan Research Council, Saskatoon.

Honourable Gordon Currie
Minister of Science and Technology, Regina.

Dr. Leon Katz
Saskatoon

Dr. Ken J. McCallum
Dean of Graduate Studies, University of Saskatchewan, Saskatoon.

Mr. H.S. Mallepeard
Director, Research, Policy and Planning, Department of Environment, Regina.

Mr. Paul Melin
Consultant, Saskatoon.

Dr. Peter N. Nikiforuk
Dean of Engineering, University of Saskatchewan, Saskatoon.

Dr. Cam Blachford
Dean of Graduate Studies, University of Regina.

Dr. John W.T. Spinks
Chemistry Department, University of Saskatchewan, Saskatoon.

Mr. Marcel de la Gorgendiere, QC
Partner, de la Gorgendiere, Randall, Pederson, Pinch and Turnbull, Saskatoon.

Mr. Alex J. Curran
President, SED Systems, Saskatoon.

Mr. Oscar Hanson
Vice-President, Customer & Corporate Services, Saskatchewan Power Corporation, Regina.

Ms. Adeline Morris
President, Morris Rod Weeder, Yorkton

Mr. John Nightingale
Vice-President & General Manager, International Minerals & Chemicals, Esterhazy.

Dr. Warren Stock
Director, NRC, Plant Biotechnology Institute, Saskatoon.

Mrs. Carol Teichrob
Moonvale Farms, Saskatoon.

EXECUTIVE OFFICERS OF THE COUNCIL'S STAFF

President ..... J. Hutch

Sector Directors

Environment ..... J. Maybank
Industrial Technology Transfer ..... A. Scharf
Resources ..... W.H.W. Husband
Services ..... R.E. Melvin
Special Projects ..... J.L. Bergsteinsson

Controller ..... R. McGrath

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